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## OptiMOS® Power-Transistor

### Feature

- N-Channel
- Enhancement mode
- 175°C operating temperature
- Avalanche rated
- dv/dt rated

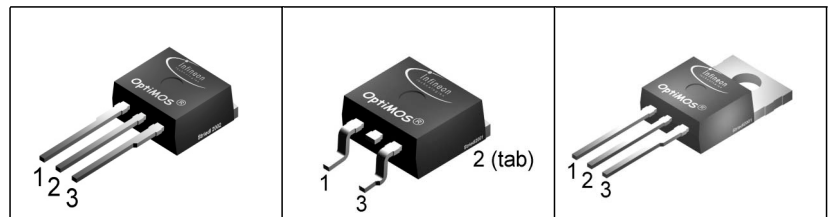
### Product Summary

$V_{DS}$	40	V
$R_{DS(on)}$ max. SMD version	3.4	mΩ
$I_D$	80	A

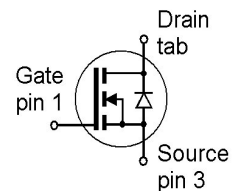
P- TO262 -3-1

P- TO263 -3-2

P- TO220 -3-1



Type	Package	Ordering Code	Marking
SPP80N04S2-04	P- TO220 -3-1	Q67040-S4260	2N0404
SPB80N04S2-04	P- TO263 -3-2	Q67040-S4257	2N0404
SPI80N04S2-04	P- TO262 -3-1	Q67060-S6173	2N0404



### Maximum Ratings, at $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current <sup>1)</sup>	$I_D$	80	A
$T_C=25\text{ °C}$		80	
$T_C=100\text{ °C}$		80	
Pulsed drain current	$I_D$ puls	320	
$T_C=25\text{ °C}$			
Avalanche energy, single pulse	$E_{AS}$	810	mJ
$I_D=80\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ Ω}$			
Repetitive avalanche energy, limited by $T_{jmax}$ <sup>2)</sup>	$E_{AR}$	30	
Reverse diode dv/dt	dv/dt	6	kV/μs
$I_S=80\text{ A}$ , $V_{DS}=32\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{jmax}=175\text{ °C}$			
Gate source voltage	$V_{GS}$	±20	V
Power dissipation	$P_{tot}$	300	W
$T_C=25\text{ °C}$			
Operating and storage temperature	$T_j, T_{stg}$	-55... +175	°C
IEC climatic category; DIN IEC 68-1		55/175/56	

### Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Thermal resistance, junction - case	$R_{thJC}$	-	0.3	0.5	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	62	
SMD version, device on PCB: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>3)</sup>	$R_{thJA}$	-	-	62 40	

### Electrical Characteristics, at $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	40	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=250\mu A$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$ $V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^2)$	$I_{DSS}$	-	0.01 1	1 100	$\mu A$
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	$I_{GSS}$	-	1	100	nA
Drain-source on-state resistance <sup>4)</sup> $V_{GS}=10V, I_D=80A$ $V_{GS}=10V, I_D=80A, \text{ SMD version}$	$R_{DS(on)}$	-	3 2.7	3.7 3.4	m $\Omega$

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 0.5K/W$  the chip is able to carry  $I_D = 208A$  at  $25^\circ\text{C}$ , for detailed information see app.-note ANPS071E available at [www.infineon.com/optimos](http://www.infineon.com/optimos)

<sup>2</sup>Defined by design. Not subject to production test.

<sup>3</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

<sup>4</sup>Diagrams are related to straight lead versions

### Electrical Characteristics

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

### Dynamic Characteristics

Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 80A$	60	125	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = 25V$ , $f = 1MHz$	-	5250	6980	pF
Output capacitance	$C_{oss}$		-	1870	2490	
Reverse transfer capacitance	$C_{rss}$		-	420	630	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 20V$ , $V_{GS} = 10V$ , $I_D = 80A$ , $R_G = 2.2\Omega$	-	16	24	ns
Rise time	$t_r$		-	45	68	
Turn-off delay time	$t_{d(off)}$		-	50	75	
Fall time	$t_f$		-	40	60	

### Gate Charge Characteristics

Gate to source charge	$Q_{gs}$	$V_{DD} = 32V$ , $I_D = 80A$	-	25	35	nC
Gate to drain charge	$Q_{gd}$		-	50	75	
Gate charge total	$Q_g$	$V_{DD} = 32V$ , $I_D = 80A$ , $V_{GS} = 0$ to $10V$	-	135	170	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 32V$ , $I_D = 80A$	-	5.3	-	V

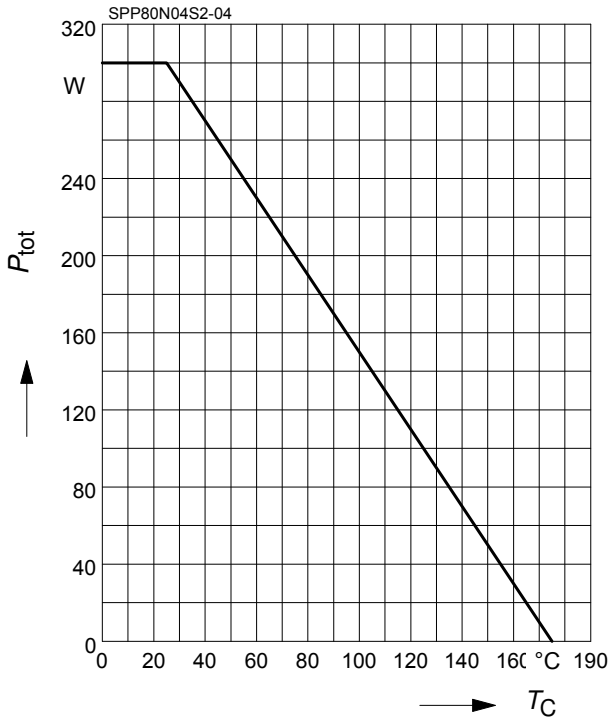
### Reverse Diode

Inverse diode continuous forward current	$I_S$	$T_C = 25^\circ C$	-	-	80	A
Inv. diode direct current, pulsed	$I_{SM}$		-	-	320	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0V$ , $I_F = 80A$	-	0.9	1.3	V
Reverse recovery time	$t_{rr}$	$V_R = 20V$ , $I_F = I_S$ , $di_F/dt = 100A/\mu s$	-	60	75	ns
Reverse recovery charge	$Q_{rr}$		-	100	125	nC

### 1 Power dissipation

$$P_{tot} = f(T_C)$$

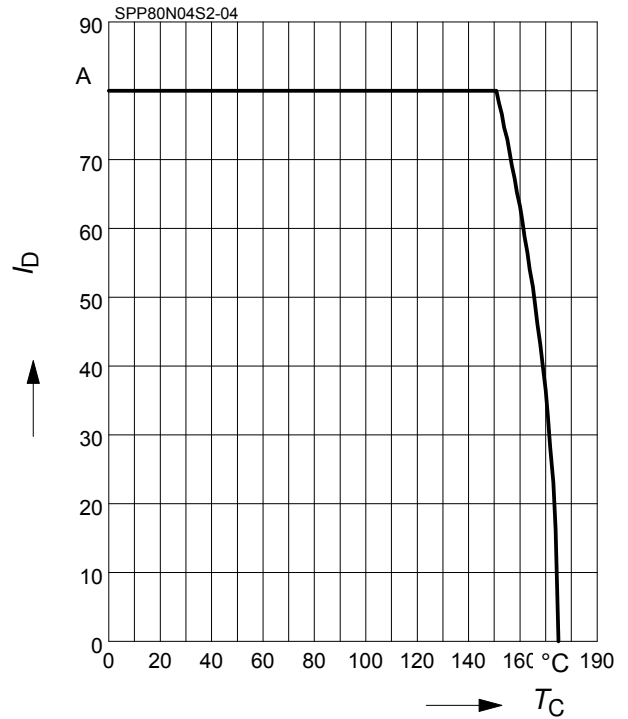
parameter:  $V_{GS} \geq 6\text{ V}$



### 2 Drain current

$$I_D = f(T_C)$$

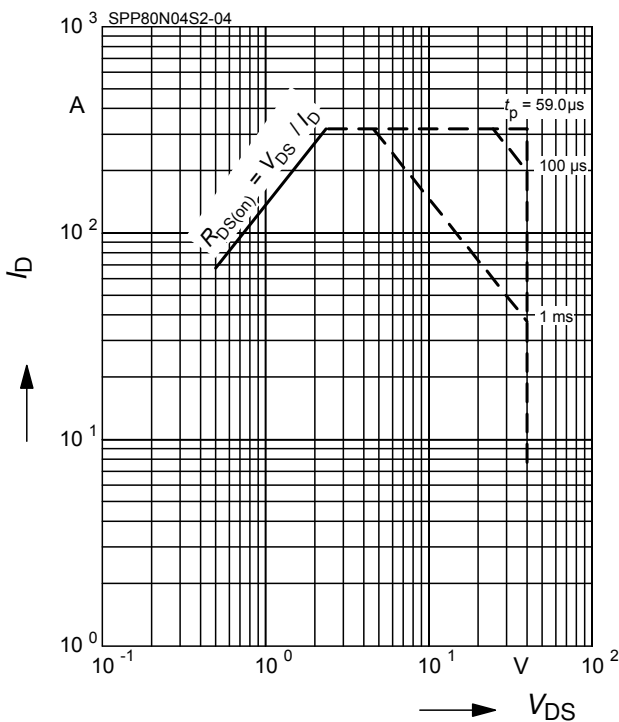
parameter:  $V_{GS} \geq 10\text{ V}$



### 3 Safe operating area

$$I_D = f(V_{DS})$$

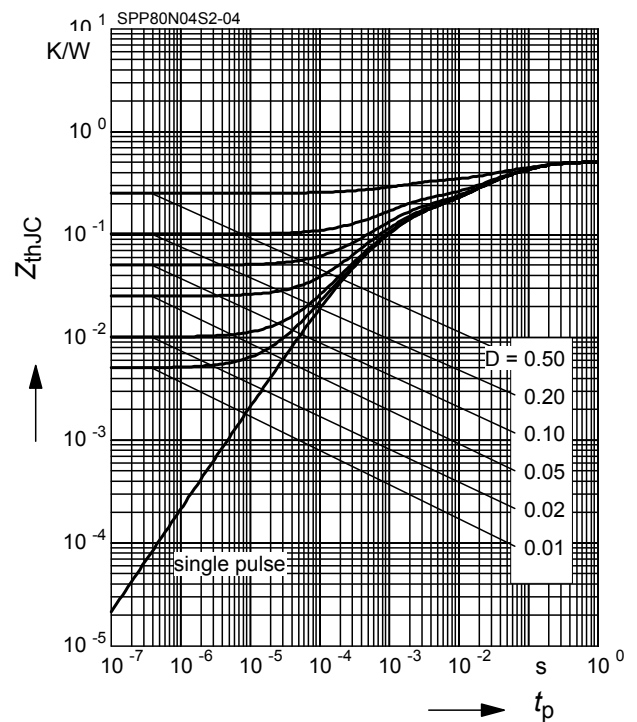
parameter:  $D = 0, T_C = 25\text{ °C}$



### 4 Max. transient thermal impedance

$$Z_{thJC} = f(t_p)$$

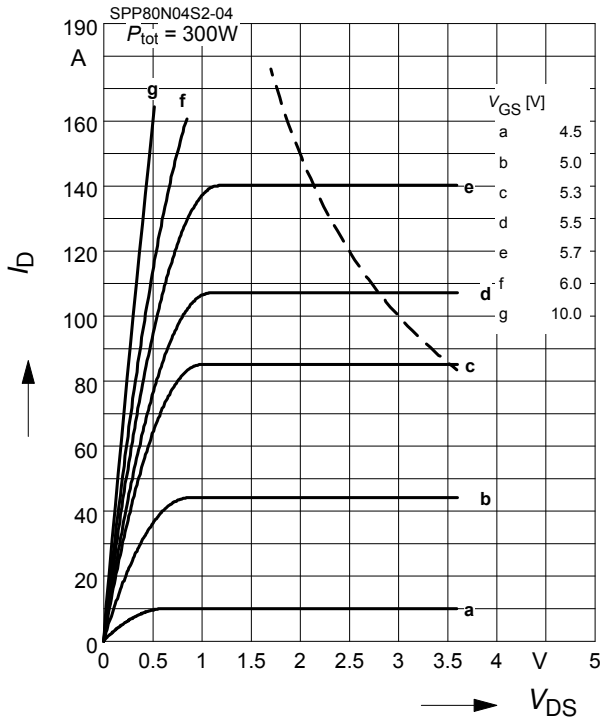
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$

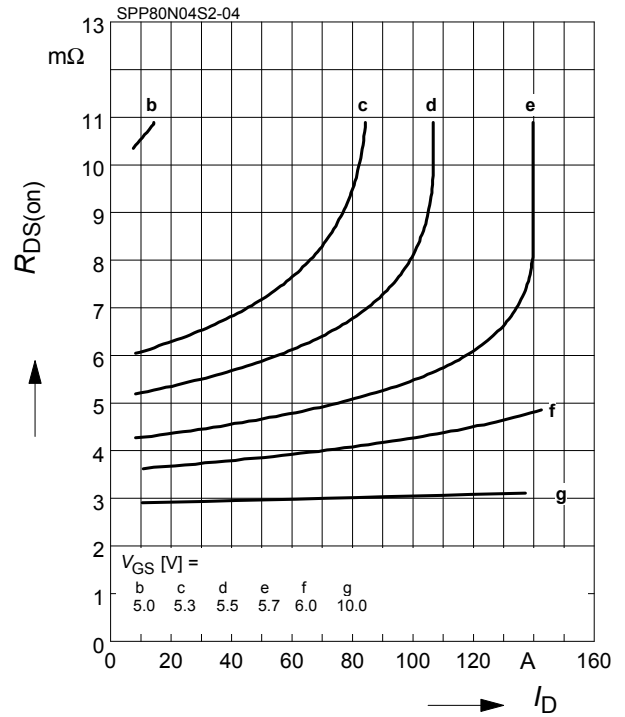
parameter:  $t_p = 80 \mu\text{s}$



**6 Typ. drain-source on resistance**

$R_{DS(on)} = f(I_D)$

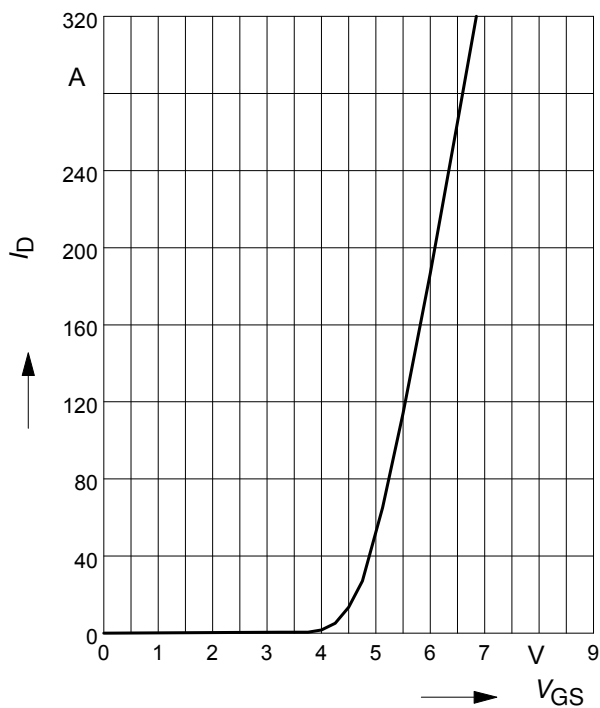
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

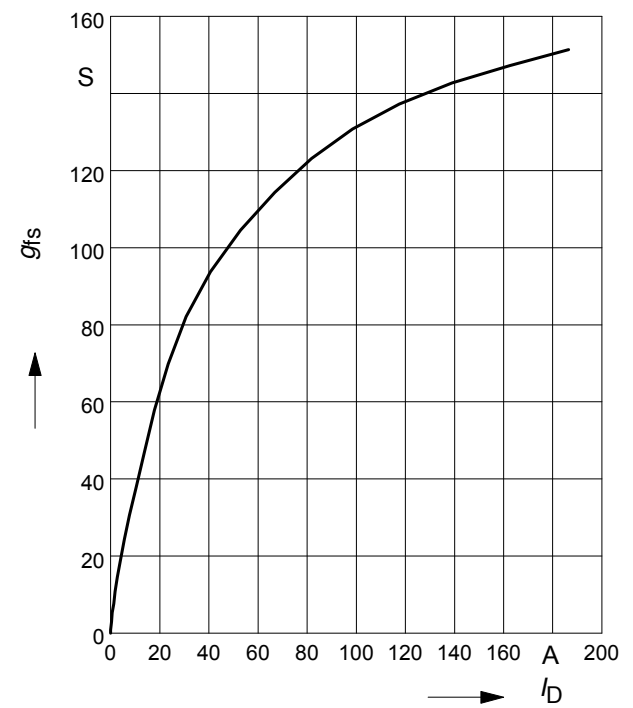
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

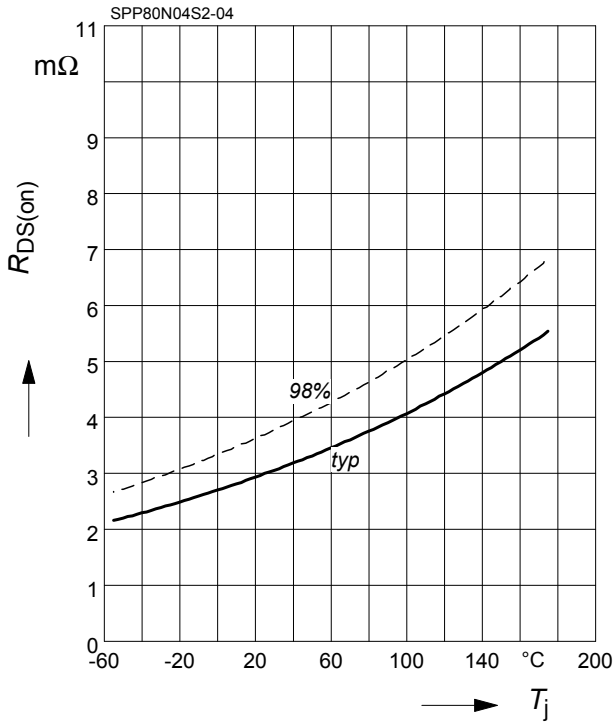
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j)$$

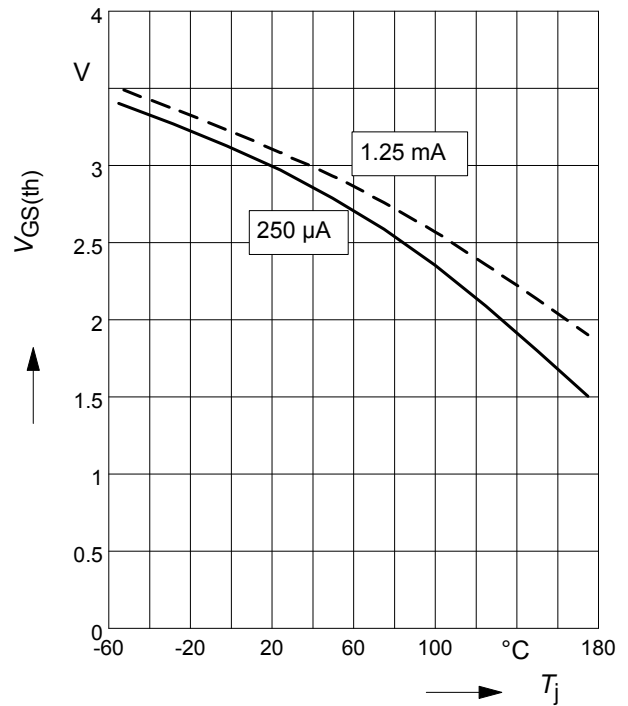
parameter :  $I_D = 80 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### 10 Typ. gate threshold voltage

$$V_{GS(th)} = f(T_j)$$

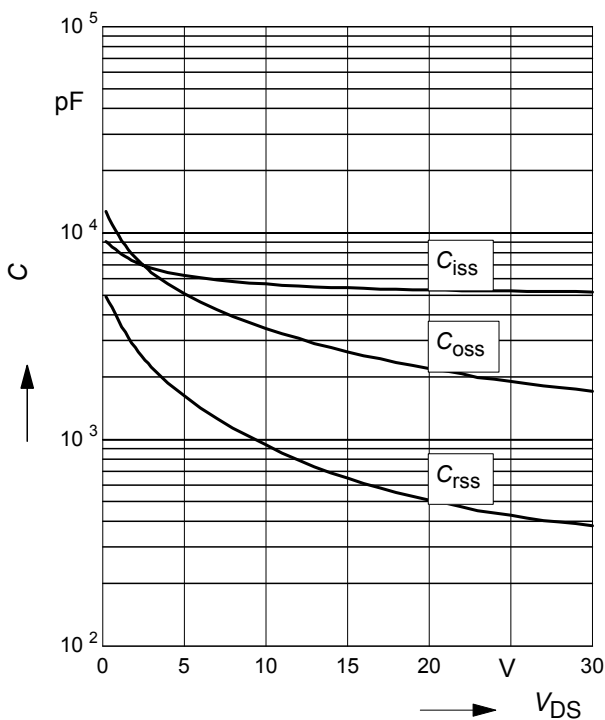
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

$$C = f(V_{DS})$$

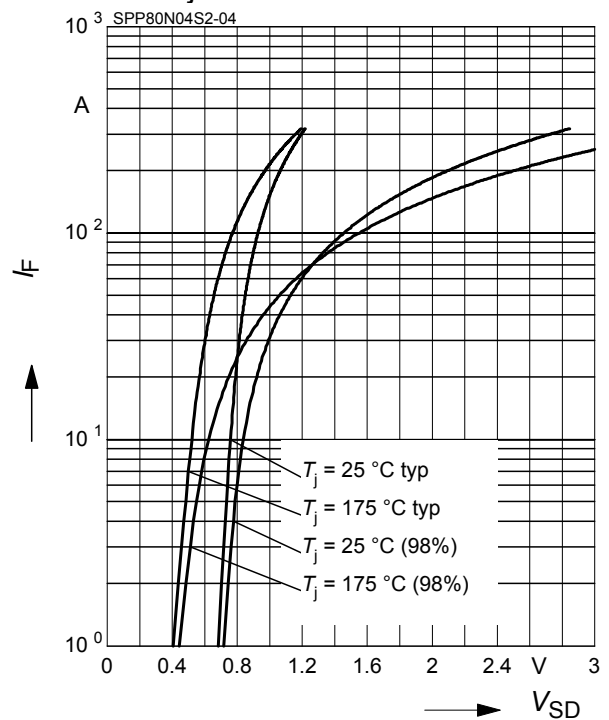
parameter:  $V_{GS}=0\text{V}$ ,  $f=1 \text{ MHz}$



### 12 Forward character. of reverse diode

$$I_F = f(V_{SD})$$

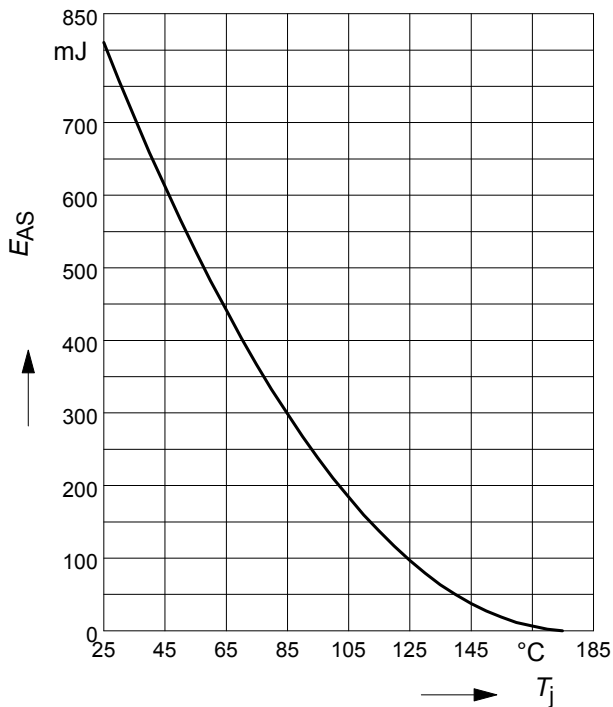
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



### 13 Typ. avalanche energy

$$E_{AS} = f(T_j)$$

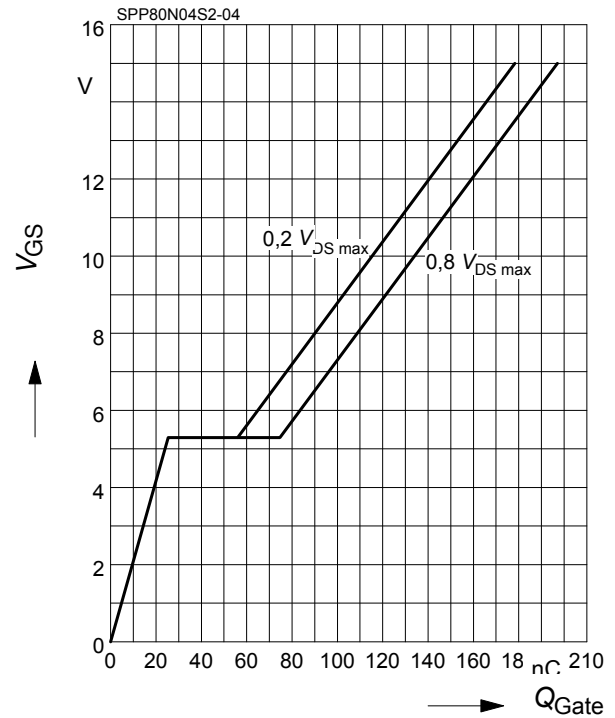
par.:  $I_D = 80 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



### 14 Typ. gate charge

$$V_{GS} = f(Q_{Gate})$$

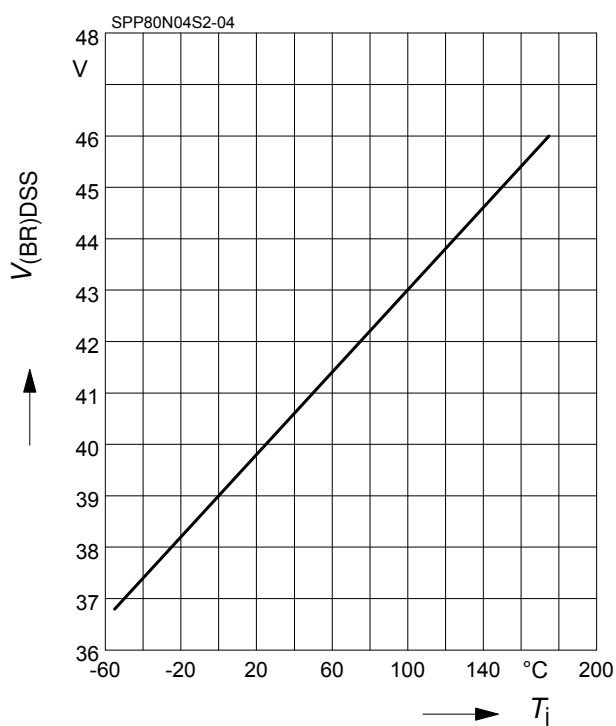
parameter:  $I_D = 80 \text{ A}$  pulsed



### 15 Drain-source breakdown voltage

$$V_{(BR)DSS} = f(T_j)$$

parameter:  $I_D = 10 \text{ mA}$





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**Further information**

Please notice that the part number is BSPP80N04S2-04 and BSPB80N04S2-04, for simplicity the device is referred to by the term SPP80N04S2-04 and SPB80N04S2-04 throughout this documentation.